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Assessment of Cadmium (Cd) and Copper (Cu) Hazard Metal in Anadara Shell from Kendari Bay South Sulawesi in 2019

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ABSTRACT

Cadmium and Copper Heavy Metals that have high concentrations in marine biota are a major cause of human health risks if consumed continuously. This study aims to determine the amount of metal concentrations in shellfish if the heavy metal content is high in shellfish at risk for non-carcinogenic effects.
An observational study with a draft risk analysis. Cd and Cu levels in fish, and shellfish were measured by Atomic Absorption Spectrometry (AAS), while population body weight, population intake, and exposure frequency were measured quantitatively by interviewing 92 respondents calculating Question Cd and Cu Hazard Targets.
The results showed that Cadmium Levels in Cadmium Levels in *Anadara sp* Shells obtained the highest metal concentration of 0.549, the lowest metal concentration of 0.061 . While the copper content in *Anadara sp* shells obtained the highest metal concentration of 1,737, the lowest metal concentration was 0.205, whereas in *polymesodic* shells *there was* no metal content of Cadmium and Copper. After further analysis, *Anadara sp* shells were found to be unsafe for 30 years due to toxic risk for body.

Keywords: Hazard, Risk, Cadmium (Cd), Copper (Cu), Hazard metal.

INTRODUCTION

The waters of Kendari Bay have many marine biota. Fish and shellfish are marine biota that are very much found. Fish and shellfish are generally found directly in the waters of Kendari Bay and community aquaculture. The coastal communities of Kendari bay consume fish and shellfish almost every day. Marine biota is widely consumed because it has high protein, many are sold on the roadside and the price can be reached by the community. However, fish and shellfish are a type of marine biota that easily accumulates pollutants. Fish and shellfish that contain lead metal even though at low levels, if consumed continuously, over time will cause health risks.

Human activities in utilizing coastal areas often produce pollutant waste that can endanger marine life and specifically disrupt the development of shellfish community types. Increasingly increasing human activities in various sectors of life result in increasing environmental stresses on the waters due to the entry of waste from various activities in the areas that have been built in the coastal area, so that at one time it can exceed sea water balance which results in polluted waters.

Along with the advances in industrial technology, the increasingly developed products, so that benefits can be felt for human life. Another influence of this development, which is not useful, is industrial waste as a by-product of waste, which is channeled into free waters, such as rivers. If the results of the waste are not processed properly and perfectly, it will have an adverse effect on the surrounding environment, resulting in environmental pollution problems. Some types of substances commonly found in industrial wastes are lead (Pb), cadmium (Cd) and copper (Cu) produced by certain industries , estuary areas become the deposition of waste material / waste so that the estuary area is an area that receive the most pressure on the impact of these waste materials (Rahmawati, Hamzah, Nuryanti. 2015).

Waste containing heavy metal or heavy metal is categorized as hazardous and toxic waste. Waste containing heavy metals is an environmental problem that is of concern to many parties, especially for industries in the country. The problem of heavy metal waste is very seriously considered considering the impact it has on the life of living things, including humans. Heavy metals can cause health problems.

As it is known that environmental pollution caused by the presence of pollutants containing heavy metals, is harmful to life and life, both directly (aquatic ecosystems) and indirectly (humans). The presence of heavy metals in the aquatic environment is very necessary to be tested for their existence in both these bodies and for the organisms that inhabit them. For this reason, testing of heavy metal content in this study was carried out on water, sediments and fish and shellfish as test organisms. The heavy metals observed are cadmium (Cd). Cadmium (Cd) which enters the body of the water as an effect of human life activities has various forms. Among them are waste water from industry related to Cadmium (Cd), waste water from mining of lead ore and the rest of the battery industry. The waste will fall on the waterways such as the river mouth to then be carried on to the ocean. Heavy metal cadmium (Cd) and various forms of compounds can enter the environment, especially the side effects of human activities. Metal cadmium (Cd) will also undergo the process of biotransformation and bioaccumulation in living organisms. This metal enters the body with food consumed, but the food has been contaminated by logs and compounds (Zulkarnain, 2019) .

Blood clams are known as a group of cockle shells that have parts of the shell are attached to each other at the boundaries of the shell. The outer shell of the shell is generally white and webbed with a brownish layer. Called blood clams because these clams have red blood pigments or hemoglobin called bloody cockles, so that these shells can live in conditions of relatively low oxygen levels, Anadara granosa is a type of marine animal that the people of Semarang like to have high nutrition such as protein. 19.48%, 74.37% water, and 2.48% fat in boiled blood clam meat, while the protein content was 23.23%, 65.69% water, and 7.01% fat in the raw state (Nurjanah et al., 2005 in Anggraini, 2016). Apart from its advantages, blood clams get food from polluted waters, so the body is also affected and if consumed by humans it will accumulate in the body and will become toxic substances that will endanger humans (Dewi et al. 2017).

METHOD

Location and design of Research

This research is located in Kendari Bay, Southeast Sulawesi, at eight sampling points, the first point is located in the Fish Auction Area, the second point is located in Kendari Bay bridge, the third point is located in community waste disposal, the fourth point is located in the waste water receiving agency the fourth is located in the receiving water body, point five is located in the final waste and resident garbage, the sixth point is located in the river water flow to Kendari bay, the seventh point is located at the shop's bridge, while point eight is located in the bay stream before going to the open sea.

Population and sample

The population in this study were all residents who consumed Anadara shellfish from Kendari bay as many as 92 respondents, while for the population in this study were Anadara Granosa shells in the bay waters of kendari. The sample (respondent) in this study is that residents around Kendari Bay consume shellfish from Kendari Bay, sampling is done by purposive sampling.

Method of collecting data

The primary data obtained from direct measurements in the field / location of research and investigation in the laboratory which includes data such as: The laboratory tests the concentration of Cd and Cu contained in the flesh of shellfish taken from Kendari Bay, rate of intake of shellfish by residents who responded to the study, the weight of the population used by respondents in the study, the frequency of exposure to consumption of fish, crabs, shellfish and shrimp originating from Kendari Bay .

RESULT

Based on the length of stay of respondents in the study location, 32 people (37.5%) had occupied the study site for less than 20 years, 34 people (39.5%) had occupied the location for 20-30 years. While the rest, 26 people (28.71%) have settled in that location for more than 30 years. Based on employment, 6 people (6.53%) respondents work as civil servants, 2 people (2.2%) work as TNI / POLRI, 31 people (33.7%) work as private workers, 15 people (16.3 %) work as entrepreneurs, 16 people (17.4%) work as traders, 14 people (15.2%) work as fishermen and 8 people (8.7%) work as Others in this case such as housewives, students cafe workers and other professions.

Based on the results of the study, it was found that as many as 9 people out of a total of 92 respondents consumed shellfish. While the rest do not consume shellfish but consume crabs, salted fish, squid, egg tofu and other tempeh. The types of shellfish that are most often consumed by residents around Kendari Bay are of two types, namely blood shells *(Anadara. Sp)* and Kalandue shellfish *(Pelecypoda sp).*

Based on the results of the study that as many as 38 people from a total of 92 respondents who consumed fish and shellfish every day in different amounts each day

Based on the results of the examination of AAS, Kalandue shells (*polymesoda erosa*) found no cadmium and Copper content in the meat so that people who *consumed polymesode erosal* shellfish *were* not followed in the calculation of risk analysis. While shells anadara granosa (*blood clams*) contain metals Cadmium and Copper.

Based on the results of laboratory tests for Cadmium and Copper metals in shells laboratory results were obtained for the highest metal concentrations, namely at the highest concentration of cadmium metal obtained in the shells of anadara sp at point 7 which is located in the bay stream before going to the open sea. Whereas the highest concentration of copper metal in Anadara Granosa shells is obtained from point 3, which is located in the waste stream discharge from the household to the waste water receiving body in Kendari Bay. For standard consumption of cadmium metal in shells of 100 grams / day, for standard consumption of copper ogam in Anadara granosa shells 0.22 gram / day.

The results of the examination of cadmium levels on average in clam meat are 0.257 mg / kg. The highest levels are 0549 mg / kg, while the lowest level was 0.061mg / kg. and the results of the examination of the average Copper content in shellfish are 0.406 mg / kg. The highest levels are 1737 mg / kg, while the lowest level was 0.205mg / kg

Respondents who met the requirements were respondents who consumed blood clams at least 1 time a month. Table 8 shows that the average intake rate of shellfish is 100 grams / day (cadmium) and 0.021 grams / day (Copper).

The average frequency of exposure of respondents who consumed shellfish from Kendari Bay was 1 day. With the highest exposure frequency of 365 days / year. The average body weight of respondents who consumed shellfish was 58.6 kg, with the lowest body weight of 49 kg and the highest weight of 74 kg (Cadmium). Whereas for Copper The average frequency of exposure of respondents consuming shellfish from

Kendari Bay is 1 day. With the highest exposure frequency of 365 days / year. The average body weight of respondents who consumed shellfish was 58 kg, with the lowest body weight of 42 kg

Estimated level of risk for the duration of 30 years exposure with Cd content in shellfish is 0.00077 mg / gram (lowest cadmium content in shells). The results show that the average Cd Intake experienced by the population is 0.261 x 10 $^{-4}$ mg / kg / day the highest daily intake is 4,614 x 10 $^{-4}$ mg / kg / day and the lowest is 0.076 x 10 $^{-4}$ mg / kg / day (IRISH. 2010).

With the daily average intake, the population has a level of risk (RQ) an average of 0.026 with the highest risk level of 0.461 and the lowest of 0.0076.

Risk level estimation (RQ) was carried out for 30 years exposure duration with Cd content in shellfish at 0.0549 mg / gram (highest cadmium level in shells), and risk level estimation (RQ) performed for 30 years exposure duration with CU levels in shellfish amounting to 1,737 mg / gram (highest cadmium content in shellfish).

Table 1 . Distribution of respondents based on gender, age, education and employment in Kendari Bay, Southeast Sulawesi in 2019

Variabel	Category	Frequency	%
Gender	Man	45	48.9
	Woman	47	51.1
Age (year)	20-30 years	53	57.6
	31-40 years	24	26.1
	41-50 years	13	14.1
	51-60 years	2	2.2
Education	No school	13	14.1
	Elementary school	10	10.9
	Junior high school	6	6.5
	High school	33	35.9
	S1	24	26.1
	S2	3	3.3
	Others	3	3.3
Length of stay (years)	›20 years	32	37.5
	20-30 years	34	39.5
	‹30 years old	26	28.71
Work	Government employees	6	6.5
	TNI / POLRI	2	2.2
	Private	31	33.7
	Entrepreneur	15	16.3
	Traders	16	15.2
	Others	8	8.7

Table 2 . Cadmium and Copper levels in Selfish from Kendari Bay, Southeast Sulawesi in 2019

No.	Sample	Sample Weight (mg/kg)	Sample volume	Levels of Cd (mg / kg)	Cu content (mg / kg)
1.	Kerang Anadara 1	10.4616	25	0.166	0.205
2.	Kerang Anadara 2	10.2673	25	0.322	0.240
3.	Kerang Anadara 3	11.0656	25	0.061	1.737
4.	Kerang Anadara 4	10.1192	25	0.288	0.307
5.	Kerang Anadara 5	10.3003	25	0.419	0.442
6.	Kerang Anadara 6	10.0275	25	0.257	0.406
7.	Kerang Anadara 7	10.7369	25	0.549	0.379
8.	Kerang Anadara 8	10.149	25	0.300	0.454

Description: Tt = undetectable

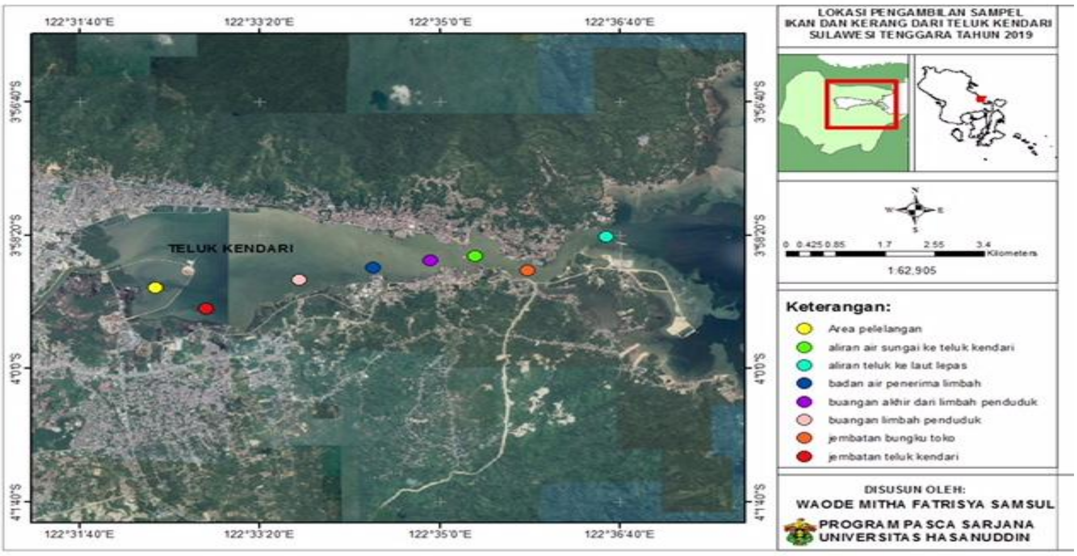

Figure 1. Research location map teluk kendari south sulawesi in 2019

DISCUSSIONS

Based on the results of the study it was found that the rate of intake, frequency of exposure, and body weight of each respondent was different. This means that the duration of safe exposure can vary for each respondent. A person with a greater body weight, a smaller intake rate and a lower frequency of daily exposure has a longer duration of safe exposure compared to someone who has a smaller body weight, a greater intake rate and a higher duration of exposure to a person. same level of cadmium and Copper.

Risk management with control of intake rates can be done by reducing the amount of consumption of fish and shellfish while maintaining other factors such as weight, cadmium levels, frequency of exposure such as the condition when the study was conducted.

Based on the results of the study it was found that the frequency of exposure and body weight of each respondent varied. A person with a greater weight, and a greater frequency of daily exposure has a safer intake rate greater than someone with a smaller body weight, and a smaller frequency of exposure.

In its application, risk management is a decision-making process for control that will involve and consider many factors such as social, economic, and relevant techniques. In order for risk management to be achieved properly eating risk management choices must be communicated with interested parties.

The highest cadmium and copper levels of cadmium in *Anadara sp.* is 0.549 mg / kg and the highest level of copper is 454 mg / kg. While *polymesode erosa* shells are not detected (not analyzed by risk). Where the safe concentration concentration standard for consumption of cadmium metal in shells for safe limit concentration of consumption of cadmium metal in *anadang* shells is 100 mg / day means that the concentration is still a safe limit for consumption and not risky, whereas for copper metal concentrations obtained from the lab itself exceeding the standard concentration that has been set at 0.22 mg / day means that it is at risk of health effects.

Health risk analysis aims to calculate the probability of health problems that might occur to the population due to consuming fish, crabs, shellfish and shrimp containing cadmium from the Tallo River. Risk analysis is carried out with four stages of study, namely hazard identification, dose response analysis, compliance analysis and risk characterization.

Someone with a lighter weight certainly has a greater risk, so to control the risk of cadmium levels must be lower than someone with a greater body weight. Likewise, the length of contact (duration of exposure), someone who is exposed to a longer period of time, will be safer if consuming fish and shellfish with a smaller cadmium and copper content compared to someone who consumes the biota with a smaller duration of exposure even though same weight. Overall controlling the levels of cadmium and Copper in Kendari Bay biota cannot be done directly through controlling cadmium and Copper levels in Kendari Bay.

The bad effects of cadmium on bones will cause bone pain symptoms, making it difficult to walk has been found in studies conducted on workers who work in industries that treat batteries in France due to inhalation of dust containing CdO particles. Cadmium poison power also affects the reproductive system and its organs. At certain concentrations Cd can kill sperm cells in men. (Palar, 2008)

The acute effect of cadmium exposure mainly results in local irritation. After ingestion, the clinical manifestations are nausea, vomiting, and abdominal pain. After prolonged exposure, kidney damage can occur due to the presence of cadmium in the human body. Proximal tubular damage to the kidneys can occur if Cd levels in the kidneys reach 200 μg / g. This tubular damage will cause an inability to reabsorb small molecule proteins, one of which is β microglobulin. Other related effects are glycosuria and reduced phosphate reabsorption from the tubules. In the later stages, hypercalcinuria may occur along with changes in bone metabolism, which can result in *asteomalasia* .

Research conducted at Mayar Gresik shows data analysis of cadmium content in mackerel in Manyar Gresik waters and Jabon Sidoarjo waters, indicating the accumulation of cadmium heavy metals. The average cadmium content in Bloated Fish in Manyar Gresik Waters shows the value at station 1 is 0.009 ppm, at station 2 is 0.01726 ppm, and at station 3 the results are 0.36186 ppm, so that from the three stations in Manyar Gresik Waters obtained the average yield of cadmium is 0.12888 ppm.

The average cadmium content in the three sampling stations showed that cadmium content in mackerel at Manyar Gresik waters was still below the SNI threshold of 0.2 mg / kg. The highest accumulation of cadmium cadmium was found in blood clams, both those in Manyar Gresik waters and Jabon Sidoarjo waters, with destruction method showed an accumulation of cadmium beat metal. The average cadmium content in mackerel at Manyar Gresik Waters shows that the value at station 1 is 1.21033 ppm, at station 2 is 1.27876 ppm, at station 3 is 1.24436 ppm, so that from the three stations in Manyar Gresik Waters the cadmium content is obtained. amounting to 1.24483 ppm. This is in accordance with the opinion of several authors who claim that shells are filter feeder animals that accumulate filtered material in their gills. In the process bacteria and other microorganisms around it can accumulate and reach harmful amounts for consumption. Based on the nature of the shellfish feeding filter filter so the potential to absorb pollutants from the surrounding environment will be higher. In the gill tissue, there is a regulation of partial metabolism that accumulates zinc (Zulkarnain, 2019).

Research in Tambak Lorok Semarang has very low levels of heavy metals, both copper and chromium. The value of Cu and Cr on the second repetition is smaller than the first repetition because at the time of the morning before taking the sample water there is rain. Although it has a small value, it still needs to be considered, especially in the life of biota that the concentration of metal in water has a close relationship with the rate of increase in its content, but this does not guarantee that the water content represents heavy metal content in the tissue. The three stations on repetition I and II have copper research results which are less than 0.001 mg / l (1 μg / l) to 0.002 mg / l (2 μg / l) in the waters of the Tambak Lorok Sea whereas in the study in wedung have results of 0 , 07 mg / l to 0.14 mg / l in Wedung waters, Demak. Even though it is located the same in the northern sea waters of Central Java, but it has quite different results, because Wedung District has 5,457 ha It is also used as agricultural land, besides there is also dock activity, fishermen transportation and shipbuilding (Dewi, et al, 2018).

k Adar heavy metals in biota that live in the contaminated area generally positively correlated with the levels of Pb on habitat. The A. granos shells examined for Pb metal content in this study were taken from three observation sites which were similar to the analyzed seawater samples. It was found that the metal content of Pb in the A. granos shells in all three observation stations was identified <0,0001 mg / l. This indicates that there is almost no accumulation of Pb heavy metals in the body of the shells during the study, although this biota is a filter feeder (Sasnita et al. 2017.)

The average Cd content in sediment, water and shellfish samples taken from the Morodemak location both at station I (coast), II (estuary) and III (river) is known to be highest in shellfish samples. This is due to absorption by shellfish from water and sediment. The Cd content in sediments at station II (estuary) is higher than station I (coast) and III (river). This is thought to be influenced by the pH measured at station II which is lower than the other two stations. In the Banjir Kanal Timur location, it is known that the highest levels of heavy metals Cd are in shells. The shells of Anadaragranos are only found at station I (beach). The physical-chemical parameter data measured at this location are the same for heavy metals Hg. The highest temperature at station I, followed by stations II and III. For Cd metals, the accumulation of metals in biota becomes higher if it is at high salinity (Wulandari. 2012).

CONCLUSIONS AND SUGGESTION

Based on the results of research on the assessment of cadmium and copper heavy metals in Kendari Bay, Southeast Sulawesi, the following conclusions can be drawn:

The concentration value of Cadmium and Copper Heavy Metals in shells originating from the bay of Kendari has exceeded the standard value of concentration which is at risk of causing disease if the marine biota is consumed by humans as high as 0.549 (at Cadmium) and 1,737 (in Copper). to calculate the Health Risk in humans due to consuming shellfish for 30 years, the concentration of cadmium and copper in shellfish has been at risk of disease because RQ values have exceeded standard 1 , Risk Management of fish and shellfish by controlling exposure duration can be reduced by reducing one's contact time with Cadmium and the thickness of the shell in the shell while maintaining factors such as weight, metal content, frequency of exposure and intake rate remained at the condition when the study was conducted.

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